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REPORT OF SURVEY CONDUCTED AT

NASCOTE INDUSTRIES, INC

NASHVILLE, IL

JULY 1996

Best Manufacturing Practices

BEST MANUFACTURING PRACTICES CENTER OF EXCELLENCE
College Park, Maryland

Foreword

This report was produced by the Best Manufacturing Practices (BMP) program, a unique industry and government cooperative technology transfer effort that improves the competitiveness of America's industrial base both here and abroad. Our main goal at BMP is to increase the quality, reliability, and maintainability of goods produced by American firms. The primary objective toward this goal is simple: to identify best practices, document them, and then encourage industry and government to share information about them.

The BMP program set out in 1985 to help businesses by identifying, researching, and promoting exceptional manufacturing practices, methods, and procedures in design, test, production, facilities, logistics, and management – all areas which are highlighted in the Department of Defense's 4245-7.M, *Transition from Development to Production* manual. By fostering the sharing of information across industry lines, BMP has become a resource in helping companies identify their weak areas and examine how other companies have improved similar situations. This sharing of ideas allows companies to learn from others' attempts and to avoid costly and time-consuming duplication.

BMP identifies and documents best practices by conducting in-depth, voluntary surveys such as this one at Nascote Industries, Inc., Nashville, Illinois conducted during the week of July 23, 1996. Teams of BMP experts work hand-in-hand on-site with the company to examine existing practices, uncover best practices, and identify areas for even better practices.

The final survey report, which details the findings, is distributed electronically and in hard copy to thousands of representatives from government, industry, and academia throughout the U.S. and Canada – *so the knowledge can be shared.* BMP also distributes this information through several interactive services which include CD-ROMs, BMPnet, and a World Wide Web HomePage located on the Internet at http://www.bmpcoe.org. The actual exchange of detailed data is between companies at their discretion.

Nascote Industries is a major supplier of exterior trim products to the automotive industry. In addition to being committed to quality products and environmental issues, the company maintains a strong commitment to its workforce. The employees reflect this pride, as evidenced by the low company turnover rate of less than 1%, and were a pivotal factor in the company receiving the General Motors Fascia Supplier of the Year award for 1994 and 1995.

The Best Manufacturing Practices program is committed to strengthening the U.S. industrial base. Survey findings in reports such as this one on Nascote Industries expand BMP's contribution toward its goal of a stronger, more competitive, globally-minded, and environmentally-conscious American industrial program.

I encourage your participation and use of this unique resource.

Ernie Renner
Director, Best Manufacturing Practices

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Section 1

Report Summary

Background

Nascote Industries, Inc., formed in 1985, is one of three plants run by the Conix Corporation, a joint venture between Magna International (51%) and the Ford Motor Company (4%). The company, located in Nashville, Illinois has 600 employees and is a major supplier of exterior trim products to the automotive industry. Sales for 1995 reached $120 million.

Nascote management maintains a strong commitment to quality of its employees' lives and in its products. Nascote employees reflect this pride, as evidenced by the low company turnover rate -- less than 1%. Management encourages employees to take an active role in plant-wide operations through teaming. Nascote employees' use of team problem-solving techniques evolved into a company focus which emphasizes the increase in productivity that teams can create, and 95% of the Nascote workforce now participates on one of many teams. Interwoven into the site's operations, teaming produces a strong sense of ownership by Nascote employees. Improvements resulting from this team effort include high quality, high first-run yields, quick mold changes, cycle time reduction, and reduced scrap in the reaction injection molding process. Processes improve easily because operator suggestions are heeded and implemented, costs are cut, and productivity is increased.

Although teaming constitutes a critical component of Nascote's success, maintaining a workforce with highly-developed skills and experience is just as important. With an average employee age of 29 and a strong work ethic, the Nascote employee provides a valuable resource to the plant and represents a pivotal factor in the company's receiving the General Motors Fascia Supplier of the Year award in both 1994 and 1995. Management recognizes this contribution by providing educational opportunities for its workforce to continue improving skills and experience.

Nascote management's dedication to the quality of the work experience is also exemplified through its proactive approach to ergonomics. Every operator movement in a process undergoes critical consideration, and changes are instituted wherever needed either in the process, tools, or layouts to ensure a safer work environment.

The company's environmental efforts represent yet another instance of Nascote's emphasis on quality. To reduce operationally-produced hazardous waste such as paint fumes, sludge, and solvent, Nascote implemented several changes including the installation of a state-of-the-art thermal oxidation system to destroy volatile organic compound emissions. The company also contracts with outside agencies to recycle the paint sludge into products used by other industries. In addition, Nascote has instituted cleaning its paint solvent for reuse.

The company's commitment to the workforce and the environment is paralleled only by its commitment to producing a quality product. Nascote continually improves its operation through successful practices such as statistical process control to help predict process variations; the business plan development process--a customer-driven strategic plan for the next fiscal year's plant operation; and the program launch which ensures all activities required for the introduction of new programs are planned for and instituted.

Nascote's corporate commitment to quality acknowledges that quality in its workforce and quality in its products are irrefutably linked. That strong link helps Nascote position itself as a world-class leader in automotive exterior trim products and provides the basis for the following best practices the BMP survey team found to be among the best in government and industry.

Best Practices

The following best practices were presented at Nascote.

Information

The following information items were presented at Nascote.

Point of Contact

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Section 2

Best Practices

Production

8-D Problem Solving Process

Prior to 1995, Nascote used conventional root cause analysis, fish bone charts, resolution reports, and corrective action reports to identify and prevent recurrences of customer concerns related to product quality and defects. This process was carried out primarily by management, and was not always a well-disciplined approach for providing total resolution of recurring problems.

Since early 1995, Nascote has used the Ford Motor Company 8 Discipline (8-D) Problem-Solving Process to identify and correct customers' product quality and reliability concerns. The 8-D problem solving process, a team-oriented method of problem solving, applies process and statistical tools as its basis. Process tools are thought processes requiring a unique set of steps; statistical tools are validation and verification techniques used to display easy-to-understand and easy-to-use information.

The four process tools used in this 8-D process are Concern Analysis, Problem Solving, Decision Making, and Planning and Problem Prevention. Each process tool has a unique purpose and leads the problem-solving team in a disciplined approach for correcting and preventing the customer's product quality and reliability concerns. A wide range of statistical tools such as cause and effect diagrams, Design of Experiments, and failure mode and effect analysis are used throughout the 8-D process.

The 8-D program requires a team leader (a company manager) who leads the activities of the team and who has the authority to implement change. Team members with the most knowledge of the process are chosen from the workforce. Since over one-third of the work force has extensive training in the 8-D process, Nascote can systematically resolve difficult problems which were previously unsolvable. By emphasizing Advanced Quality Planning, problems are prevented from occurring with future programs. The 8-D process is now used extensively throughout the company, addresses customer concerns and helps alleviate problems.

Besides resolution of customer concerns and problem prevention, Nascote has applied the 8-D process to identify root causes and prevent recurrence of OSHA recordable injuries. Since implementation of the 8-D process in safety, Nascote's OSHA Recordable Incidence and Lost Workday Case Rates have dropped from 16.6 and 11.3 in FY92 to 6.0 and 2.6 respectively, in FY96. The normal incidence for the plastics industry is 13.1 and 6.2. In addition, Nascote has reduced its Workers Compensation costs from $844,189 in FY92 to $110,760 in FY96 -- a $733,429 reduction. Key to this significant cost savings was the disciplined approach of the 8-D program and the make-up of the team. As in process and quality problems, the employees are the most knowledgeable on the processes causing an injury.

Nascote has showed that the 8-D problem solving process is an effective means for solving customer concerns and problem prevention in a manufacturing process as well as other environments.

Cycle Time Reduction

Nascote Industries has implemented an aggressive plan to reduce its product cycle times on all products with up to a 50% reduction on some product types. Nascote's previous set-up reflected a cycle time of 110 seconds for an 11-pound fascia and 125 seconds for a 14-pound reinforcement. Realizing that cycle time reductions could lead to new and additional business, management pursued the cycle time reduction effort.

Nascote's specially-assembled team looked at the normal industry cycle time reduction efforts and determined that the current approach would not yield the desired results. Instead, the team investigated the actual functionality of the molds. Findings indicated a savings could be achieved by changing the approach to the filling of the mold with raw materials. Because nothing on the market would offer the company a reduction with current technology, Nascote changed the standards of high production molding methodology.

The team developed a design for the mold to fill using sequentially-operated gates and a mechanical shutoff. This approach resulted in the application and approval of a patent for a Sequential Valve Gate System. Working in conjunction with an injection press manufacturer, Nascote developed soft-

ware which allowed the gate to open and close in relation to the fill auger screw speed. Through perseverance and expertise, a method once thought unattainable was developed and implemented.

Results have yielded an average cycle time reduction of 33%. The 11-pound fascia's cycle time has been reduced from 110 seconds to 75 seconds. The 14-pound reinforcement's cycle time dropped from 125 seconds to 89 seconds, and Nascote currently has some fascias running at a cycle time of 65 seconds per part. The company is currently tasked with a cycle time reduction target of 60-65 seconds per part. Through this effort, Nascote has avoided the cost of procuring two additional presses for business that was awarded subsequent to the process change, thereby saving $6 million. The reduced cycle times have helped to increase manufacturing flexibility and inventory control, and also provided a higher return on quoted business.

Paint Cycle Time Reduction (Changeover)

Upon expansion of its customer base and parts mix, Nascote became concerned about product paint changeovers. With the vast parts mix, numerous colors, style, and process changeovers required (approximately 40 per day), the time needed to execute changeovers started affecting throughput and inventory. In 1993, Nascote's painting operation underwent massive changes, driving the focus for improvement to the actual changing of materials in the spray guns.

With emphasis placed on finishing materials, Nascote formed a team of process engineers, technicians, and paint system operators to reduce cycle times by using existing methods as the baseline. The 1993 system modernization had improved the cycle times somewhat, thus directing emphasis on delivery systems. Additional changes had to be addressed by process improvements. By timing the changes through sufficient notice from the Scheduling Group, Nascote reduced not only the time required but associated material waste as well.

Nascote benchmarked its process improvements against others in this industry and maintains it is among the best in the automotive exterior trim product manufacturing industry. The company will continue to strive for world-class process enhancements.

Paint First Run Yields

Nascote ensured high-quality first run yields on its plastic injection molded parts through the development of and compliance to documented processes. Because its plastic injection molded parts used substrates with inherent painting problems, first run yields were a high priority. Nascote's customer required that fascias be painted separately from the automobile; consequently, color match and quality of the applied finishes were also critical. Nascote formed four teams of experts to address these industry problems. The teams are comprised of paint process engineers, technicians, and suppliers.

Part preparation was the first issue of the team's focus. While electrostatic painting was normal for these plastic-injection molded products, some substrates were non-conductive such as Xenoy. However, once the part was sprayed it became conductive, attracting contaminates to the wet surface. Nascote developed a process of rinsing the part with ionized water to remove any charge, then applying an adhesion promoter to ensure bonding of the basecoats. After spraying this adhesion promoter to a thickness of 2-4 mils, the fascia could then continue with the standard procedure. This method proved successful, but incurred an additional cost; however, through Design of Experiments (DOE), Nascote determined that by applying the adhesion promoter, the basecoat paint usage was reduced by 50%. Instead of the previous 10 pieces per gallon of basecoat, 20 pieces per gallon could be produced by using the adhesion promoter. When compared to the cost of basecoat paint, $150 per gallon, the additional costs of the adhesion promoter were offset. This innovative approach received customer approval.

Painted surface contamination was another issue, as application of materials made the parts tacky. Two personnel from Nascote's painting department were assigned full-time responsibility to identify and catalogue contaminates (Figure 2-1), allowing process engineers to address specific entry of each contaminate. This approach helped Nascote achieve an 86-90% average for first run yields. The results highlighted the benefit of Nascote's approach to document and adhere to strict guidelines in achieving high-quality first run paint yields on its plastic injection molded parts.

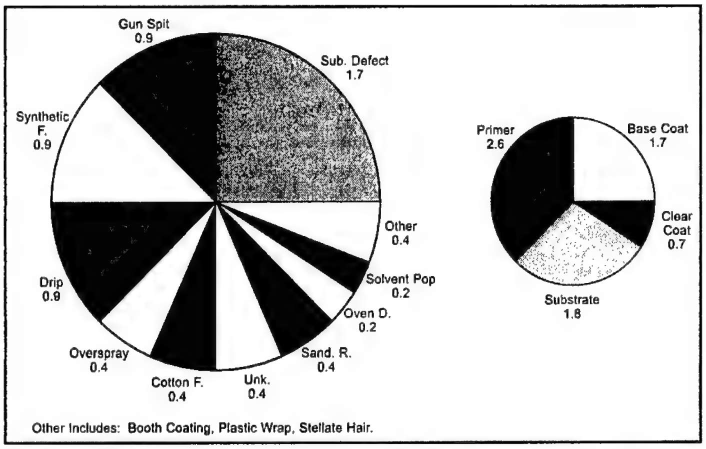


Figure 2-1. Buick Product Line Contamination for June 1996

Paint Fumes Management

Nascote installed a regenerative thermal oxidation system from the Salem Corporation to control volatile organic compound (VOC) emissions from its paint lines due to escalating production levels. When the company began operations, it received certification from the Illinois Environmental Protection Agency (IEPA) to operate its paint lines under the 'small plant' plant classification that stipulated emissions of less than 249 tons per year of VOCs per coating line. The plant was designed to come up to full production in three stages, each stage to include additional pollution control equipment to comply with the IEPA standards. Stage one consisted of thermal incineration of all bake oven air, and the following two stages included the abatement of spray booth exhaust as production levels increased. Production levels, however, increased more rapidly than expected and Nascote began exceeding the VOC emission limits in early 1988, prematurely entering into stages two and three. Although extensions of operating certification were obtained that permitted the plant to operate through 1989, Nascote determined that installation of an abatement system would be necessary to meet IEPA requirements and to satisfy the EPA requirement to demonstrate best available control technology.

The regenerative thermal oxidation system from Salem Corporation is a regenerative system that reuses assets such as heat, energy, and pressure, which would otherwise be wasted. Regenerative thermal incineration destroys fume emissions and odors by effectively reusing the heat of combustion. This particular Salem Corporation system is a multi-chamber configuration that operates in an alternating inlet/outlet mode while the off-line chamber is purged of trapped contaminants. This feature ensures that all contaminants trapped in the matrix beds and retention areas are purged with clean air after each inlet cycle. Through this purging process and the high thermal efficiency (96%), up to 99% of all volatile organic compounds are destroyed.

At Nascote, a $10 million investment in this system allowed the company to greatly exceed IEPA and EPA requirements, thereby avoiding potential bottlenecks in the future as production capacity increased, and ensuring environmentally responsible operations.

Paint Sludge Recycling

Nascote contracted with Environmental Purification Industries (EPI) of Toledo, Ohio to send paint sludge through EPI's paint waste recycling process. Nascote's paint lines included an overspray capture system which generated paint sludge, a material classified as hazardous waste by the EPA. Prior to 1993, paint sludge was collected and shipped in 55-gallon drums to a fuel blending facility and burned, a process that still resulted in pollutants being released into the atmosphere. As costs increased with this process, Nascote began investigating alternative disposal methods to improve the environment and reduce costs.

EPI accepts paint waste under a highly-controlled procedure and processes it into a granular, inert powder which can be used as a filler or pigment for products used by the roofing, rubber, paint, plastics, and sealer/caulking industries. The new process reduces the chance of spills through bulk handling and shipping of the paint sludge. Strict recordkeeping and tracking procedures are followed by EPI who issues a recycling certificate verifying the waste has been completely recycled. This certification process complies with the Resource, Conservation, and Recovery Act for conserving energy and raw materials by recycling waste.

Since 1993, over 5,000,000 pounds of paint sludge shipped to EPI from Nascote's paint overspray capture system has been recycled. In addition to eliminating 100% of the waste formerly discharged into the environment, Nascote's system reflected an annual disposal cost savings of approximately $100 thousand.

Paint Solvent Recycling

Nascote implemented a paint solvent recycling program which eliminated problems associated with recycling spent purge solvent from its painting system. The new method has also produced substantial savings for the company.

On both of Nascote's robotic paint lines, a solvent was used to achieve proper paint consistency and to purge the nozzles between frequent paint color changes. Both the color and prime lines generated spent purge solvent as a waste. The spent solvent, classified as a hazardous waste, was collected and shipped to a fuel blending facility where the waste was combined with orther materials and burned. However, this method still released pollutants into the atmosphere during incineration of the blended material. In addition, the EPA required that at least 70% of all spent solvent be captured, and only 30% of the spent solvent could be collected for shipment to the blending facility using the old method.

Under the current recycling or disposal method, initiated in mid-1996, a more efficient capture method collects over 85% of all spent solvent. Nascote pumps the spent material directly into tanker trucks and ships it to Gage Products in Ferndale, Michigan who recycles the material by cleaning out the impurities and returns the clean material to Nascote for reuse. Any spent solvent not captured is mixed with the paint sludge and treated separately. As a result of the current capture method, Nascote shows a 91% average recyclable rate for solvent and consequently, the amount of new solvent purchased is greatly reduced.

The new method has virtually eliminated spent solvent as a hazardous waste to the environment. Since May 1996, Nascote has shipped nearly 60,000 gallons of solvent to Gage Products for recycling, and the company projects annual savings of over $100 thousand per year by recycling spent solvent.

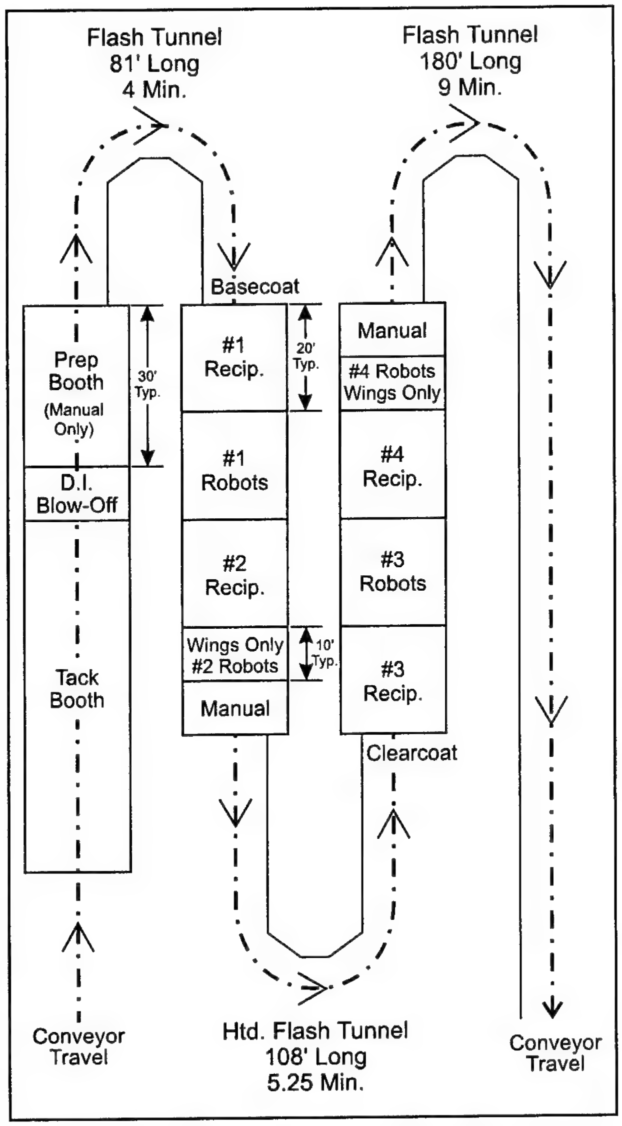


Figure 2-2. Previous Nascote Colorline Basecoat, Clearcoat Paint System

Paint Usage

Nascote installed a Durr Paint System during the construction of its facility in 1985 with paint booths to house automated reciprocators and manual paint spray stations. With low product mix and order quantity, the initial system satisfactorily handled both throughput and quality (Figure 2-2). However, Nascote's customer base and quality demands increased, and new materials imposed efficiency problems for the paint booth. Consequently in 1993, the company initiated a two-year, major paint system upgrade.

The initial paint system, developed to paint the engineered thermoplastic material Xenoy, used a dual component (2-K) paint. Personnel used six manual handgun stations in the prep booth (refer back to Figure 2-2) to provide cut-ins to areas too difficult to paint using just the basecoat system. The sequence of both basecoat and clearcoat booths consisted of reciprocator, robot, reciprocator, robot, and manual touch-up. All reciprocator zones contained three hydraulic reciprocators. Two reciprocators painted the side wings of automobile fascias

using two guns each, while the third reciprocator used six spray guns to paint the main beam surfaces of the fascias. Hydraulic robots were added later in what was originally manual spray zones. These machines exceeded the reach capabilities of the manual painters and could run continuously for long periods of time. The last portion of each booth used manual painters to eliminate mottling, to back up broken machines, and to paint areas requiring improvement. The non-conductive Xenoy was not painted electrostatically since electrostatic painting on non-conductive materials created a safety hazard. The freshly-painted charged surface also attracted contaminants.

Another substrate material, reaction injection molded (RIM), was added to the product line in 1992 and required application using a single component (1-K) elastomeric enamel paint. All RIM products required two passes through the paint system, one to apply a prime coat and the second for base and clear coats. The RIM products used the electrostatic application process in basecoat because the surface charges could be dissipated through the use of ground straps and the conductive primer.

After baselining the old process and accounting for new products, Nascote designed an alternative to a totally new system. The improved painting system uses the existing paint booths with one booth lengthened by four feet (Figure 2-3). All the original reciprocator, robotic, and manual zones were replaced by 40 Fanuc P-155 robots using Sames 501/502 electrostatic spray guns and Binks RCS fluid metering systems. There are now five, fully automated paint spray booths with eight robots per booth. This system is modular so each booth is dimensionally and functionally identical with the exception of the coatings sprayed to facilitate path development and transfer. This allowed Nascote to acquire takeover business without interruption to the customer. (Booth #1 is no longer needed for cut-ins and is used strictly to apply primers and adhesion promoters.) All basecoat and clearcoat booths contain a six-foot manual inspection zone with downdraft airflow to reduce the potential for paint contamination during the periodic visual inspection of the wet paint film. The first zone in both base and clearcoat is equipped with manual spray equipment that could be used to apply paint if necessary.

During this time, a third substrate was added at the customer's request. The new material, known

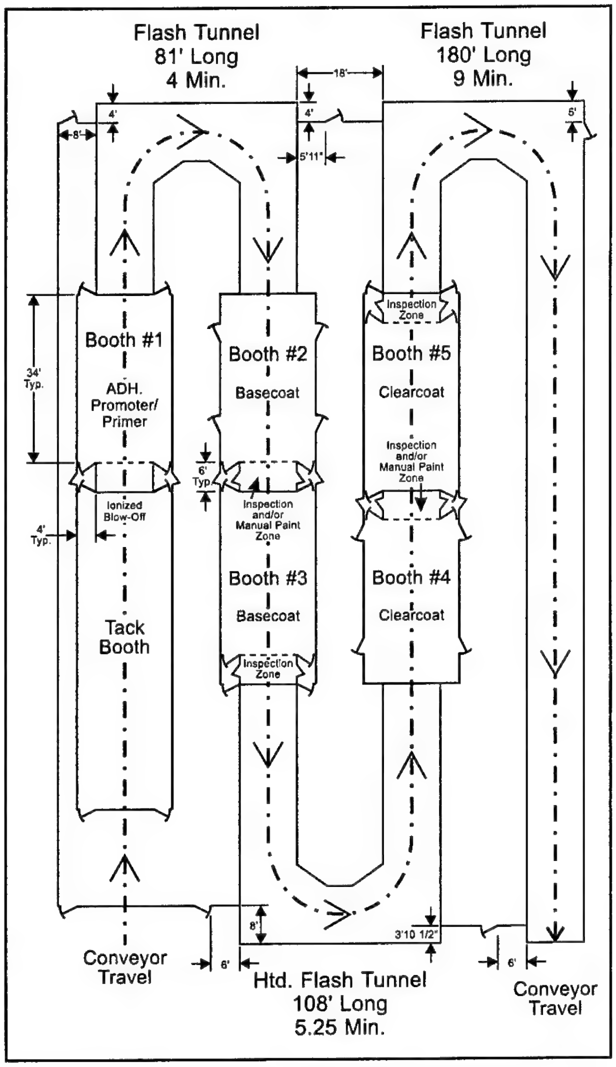


Figure 2-3. (Robotic) Nascote Colorline Basecoat, Clearcoat Paint System

as thermoplastic olefin, can be painted using either a 1-K or 2-K painting process but requires the addition of a conductive adhesion promoter prior to the basecoat paint application. Using the new robotic equipment, this requires only a single pass (wet-on-wet) through the system. Xenoy can now be painted electrostatically when used in conjunction with a conductive adhesion promoter and grounding straps.

The original equipment was removed and robotic replacements brought up to operating functionality during a semi-annual, two-week shutdown. There was no interruption in shipments. Nascote's investment in its paint system upgrades totaled

approximately $13 million for complete modifications. By eliminating wasted paints associated with color, style, and material changes; developing the electrostatic painting of Xenoy; and improving quality and throughput, Nascote realized a return on investment in 16 months. This effort contributed to the award by General Motors Fascia Supplier of the Year award to Nascote in both 1994 and 1995.

Quick Mold Change

Nascote, as a high production supplier of automobile parts to several manufacturers, accommodated almost 900 tooling changes per year at 1.8 hours per change. To decrease the tooling change time and increase productivity, a team was formed with a superintendent, supervisor, technician and one tool changer from each shift to determine how to reduce the required time for changing molds weighing in excess of 30 tons.

The team applied an "As Is" analysis technique. First, the team mapped a common tool change through each team member explaining his/her specific role during the tool change. The next step required the accurate timing of an actual tool change, noting all problems encountered during the change process. The process reflected the 1.8 hours needed to complete a mold change from the last part of the previous tool to the first acceptable part of the subsequent tool. This figure became the corporate baseline for process improvement initiatives.

The "As Is" analysis also reflected that

- there were twelve steps within the current process;
- there was a 20-minute delay while the mold was brought to operating temperature;
- the employees involved in the change process had limited skills;
- a variety of hose lengths were needed for the water connection;
- there were ergonomic implications from attaching 30-pound swivels above waist level;
- slippage from fluids lost during mold changes created safety concerns;
- there were irregular regulator and electrical connections;
- markings for connections needed to be made;
- 16 large bolts were needed to secure the mold to the press;
- a 60-pound impact gun was needed to secure these bolts;
- the tool changer had to lay on his/her back under the mold;
- acquiring the initial location of the mold on the stationary platen was difficult;
- the physical arrangement of the tool changer's tool box was important;
- the inability to locate the tool changer due to rotational assignments was a problem; and,
- scheduling did not provide ample notice for change preparation.

Armed with management's endorsement and a 30-day time line for implementation, the team developed a four-day, continuous process improvement plan. Each task was assigned to one or two members for action with a milestone for completion. The team met on a regular basis to monitor progress and provide resolution of problems encountered during the improvement process. To better develop a target of improvement, the team benchmarked two companies with a similar product line and mix.

As a result of its commitment, Nascote has become the model for companies of similar size, product, and part mix. The findings of the 'As Is' state have provided the company with the 'Perfect' state, or current six-step process. In addition, using an existing pre-heater eliminates the 20-minute heating delay, and mold changers are trained to open and close the press instead of a technician. There are common locations and hard connections for water connections to allow standardized hose lengths. Swivels are delivered prior to the molds to reduce handling, and non-slip surfaces reduce possible injuries. Regulator and electrical connections are positioned at the same location on each mold, and all water connections are marked 'in' and 'out' to eliminate connection errors. Hydraulic clamps have been designed to eliminate the 16 mounting bolts, and a more suitable impact gun has been procured. Common connection locations have eliminated the need for tool changers to lie on their backs under the molds during the change process, and location positions painted on the stationary platen have simplified the initial location of the mold. The company purchased a new cart for the tool changer's tools and tools to be ergonomically located. Tool changers have been reassigned to the re-grind room to make them accessible without disrupting the product flow. And finally, scheduling has been

prepared to provide a two-hour notice to allow sufficient change preparation.

The changes implemented resulted in a process with a completion time of less than 0.52 hours, reflecting a savings of 1.28 hours per mold change. This savings, multiplied by the number of tool changes performed, netted a dollar savings of $215,040 per year. The increased capacity now available effected a cost avoidance of $3 million because an additional molding press purchase was no longer necessary. Faster tooling changes also reduced the company's product inventory. With an improvement of this magnitude, Nascote has now changed its Tool Specification Book to ensure all future molds procured are designed for their 'Perfect' state tool change process.

Reinforced Reaction Injection Molding Process Improvement

In May 1993, Nascote established a Flash Entrapment Task Force Team to reduce scrap caused by flash entrapment in the reinforced reaction injection molding process. Prior to that time the flash entrapment scrap rate was 5.48%. The team's objective was to reduce the scrap rate from 5.48% to 2% within six months.

The team applied root cause problem solving techniques to identify the best opportunities for improvements. This approach yielded a radical outcome that significantly improved the process to the desired level. The team flipped the tool upside down, contrary to accepted industry practice. By implementing this simple idea, the flash fell off the cavity rather than into it. The new method required substantial trial and error adjustments to perfect, and maintenance personnel reprogrammed the machine and drilled new holes on the tool to accommodate the crane and face plate modifications.

Flipping the tool resulted in many improvements, such as eliminating the oil dripping into the cavity, eliminating of flash entrapment, reducing spray usage, and reducing ergonomically-related problems. Drawbacks to flipping the tool were eliminated or reduced through further analysis by the team. Nascote's reversal of tool orientation for this process was unique in the industry. It resulted in substantial productivity improvements and cost reductions. Annual savings from this improvement totaled $162 thousand at current production levels.

Statistical Process Control/Design of Experiments Process

Nascote has applied SPC since 1988 to interpret and control process capabilities and quality. Various statistical methods helped monitor the processes and predict process variations, thereby controlling the quality of the product. Nascote initiated a successful approach to SPC, with over 95% of the workforce trained in basic SPC and more than 25% of the workforce trained in advanced SPC.

The basic training consisted of eight hours of classroom training including the collection, analysis, plotting, and use of the data to understand and control manufacturing processes. The advanced SPC training was also an eight-hour training course with emphasis on process capability studies and analysis. Nascote found that a workforce well trained in SPC controls processes and communicates quality requirements to coworkers more efficiently.

In 1992, Nascote further enhanced its quality assurance by generating a formalized statistical quality assurance procedure and by training all supervisors and engineers in Design of Experiments (DOE-Taguchi methods). The DOE allowed the company to introduce new processes/products into the system with predictable and high-quality results. The disciplined requirements of the DOE ensured repeatability and reduction of process variations. Increased use of DOE was part of the ongoing pursuit for process variation reduction and Continuous Quality Improvement at Nascote Industries.

Voice Recognition System for Defect Data Collection

In 1993, Nascote purchased and installed a Wireless Voice Platform (WVP) system to help collect and reduce data in its manufacturing operations. The WVP, manufactured by CompuSpeak Inc. of Olathe, Kansas, helps Nascote ensure product quality and to address corrective actions for non-conforming products or processes.

A team of five employees previously collected defect data manually. Positioned at the end of each paint line, these employees inspected every product. Four inspectors examined the parts for defects and called out any information to the fifth employee who entered this data on paper. The tallied information was then keyed into a computer system

before any quality control reports could be generated on the next work shift. Labor intensive and error prone, this process had neither a means to identify trends in paint quality nor allowed for timely corrective actions.

The WVP system allows Nascote's paint inspectors to collect data on painted parts. Each employee wears a headset and a lightweight transceiver unit on a belt, and verbally inputs defect data. The transceiver unit communicates with a PC via radio frequency, providing real-time data collection. When an inspector inputs the defect data, the information is immediately verified by the WVP's computer-generated voice, ensuring accurate data collection. Once uploaded to Nascote's factory computer real-time, the data is immediately available for various reports.

Nascote has benefitted from the availability of real-time trend information, defect analysis, and immediate feedback. Non-conforming parts are reduced and quality is increased. In addition, WVP allows inspector mobility away from the stationary workstation; computer experience is not required to use the system; lag time between quality control inspections and quality reports has been eliminated; possible data corruption is eliminated; input errors are easily corrected through the use of voice commands; and, WVP's customizable software allows growth of the system to accommodate changes.

Management

Business Plan System

Nascote follows a structured methodology to develop its five-year business plan by using full cross-functional participation and upward communication throughout the company. This annually-prepared business plan is realistic and customer driven, both externally and internally.

Initially, Nascote's corporate-level financial input drove its five-year plan. Requirements were driven down through the company. Nascote's business plan reacted to the forecasted sales volume, profit margins, capital investments, operating cost, facility capacity, and manpower requirements for the company. The plan typically focused more on generating sufficient revenue for capital equipment acquisition and achieving specific price reductions than satisfying customer needs and supporting continuous improvement.

In 1994, Nascote Industries implemented a system, based on its management philosophy, that developed a Business Plan based less on financial input and more on the customer. The system included cross-functional participation and upward communication throughout the company. Conix corporate officers and Conix companies first conducted a strategic review approximately 11 months in advance of the budget year. This review included examining external factors, industry and external trends, general strategic direction, and the business plan timetable and schedule. Specific objectives were to determine customer needs, agree on broad-based assumptions, and assess business opportunities over the plan period.

The next step was a business plan development meeting between Conix corporate officers and Conix companies to discuss and agree on specific market, volume, and program assumptions. Next, the Nascote General Manager chaired a department manager meeting to review strategic direction defined in the Conix review sessions, to assess the plan assumptions, and to generate a list of issues and challenges facing Nascote over the plan period. At approximately eight months prior to the affected period, the Nascote controller chaired another department manager meeting to review capital funding status, carry-over funding, capital utilization, and capacity utilization. A detailed estimate of the first year's funding was established with a broad brush estimate of the succeeding four years. Using this information, each department, through active involvement of its members, identified challenges for the plan year, developed a list of priorities to be achieved, and identified capital funding to achieve priorities such as cost reduction initiatives, capacity, safety, working conditions, environmental, and repair and maintenance.

Next, a priorities review session established the content of the business plan. At this session, each department manager presented the department challenges and proposed priorities. Through a consensus process, the management team determined the cross-functional priorities to be pursued during the planned year and identified a champion for each. Each department manager agreed on the final composition of priorities for his department, and each department developed action plans to achieve these priorities. The financial department then produced documentation highlighting the implications on profits and cash flow.

The general manager prepared an overview with the previous year's synopsis and upcoming year's expectations, a summary list of specific accomplishments from the previous planned year, a summary list of challenges facing the company in the planned year, and a summary list of cross-functional and uni-functional priorities. The general manager next conducted an internal review of the business plan followed by the Conix corporate review. Upon approval from the Conix board of directors, plant meetings communicated the general plan to Nascote employees. The department managers conducted these meetings to ensure all personnel had a good understanding of the department's objectives and actions. Review of the plan, held quarterly, identified any needed changes with approval by Conix corporate.

This business plan system accomplished a realistic and effective demeanor, incorporated the Nascote philosophy, and included employee buy-in. Since 1994, Nascote and Conix corporate recognized the value of this highly successful system. By following this method, Nascote produced an effective, customer-driven business plan.

Distance Learning

As Nascote customer expectations increased, there was a corresponding need for more sophisticated processes and equipment, higher yields, reduced defects, QS-9000 certification, teaming, performance indicators, and continuous improvement. To meet this challenge, Nascote offered Distance Learning to its employees which provided them access to training and education without traveling to off-site locations such as community colleges, high schools, and health care institutions. Consequently, education that would not otherwise be provided because of the high cost of off-site training became available.

Employees previously received only the training required to perform specific, physical operational tasks. Training was one dimensional and did not address the intellectual needs of the employees. Most training took place on the job or at the plant's facilities using internal resources available to Nascote. This was non-value-added training since it was only for training's sake. With a changing global market and future workforce requirements, Nascote realized employees had to do different types of work and must be prepared and properly trained.

To effectively perform these new tasks, Nascote identified new areas of skill sets, training, and education requirements. The company teamed with 30 colleges to provide Distance Learning for the employee at a reduced cost. College instructors remain at the college and through video and audio hook-ups appear on a monitor at Nascote's Skill Center where employees take classes. Two-way audio capability is in place for instructor/student communication during lectures. This program helped offset the company's reduced in-house resources and limited funds for off-site training. In addition, efforts were made to set and approve college credit hours for all training received by employees. Nascote worked with training and education institutions to develop curriculums approved by the state. Besides providing valuable skills, employee training strengthened the overall workforce and helped internal and external future job placement. Distance Learning reduced time and travel costs, provided an average of 40 hours of annual training to each employee, and made new opportunities accessible to employees.

As a result of Distance Learning, internal staffing is now more effectively used for planning, coordination, and counseling employees. Training and educational resources are virtually unlimited. Nascote has plans for expanding accessibility to world-wide training and educational resources through video teleconferencing capability and construction of a new Distance Learning Center.

Program Launch

Nascote's Program Launch is an organized method to ensure that all activities required for the introduction of new programs to production are planned for and implemented. The program also guarantees that human resources, equipment, and facilities are available and dedicated without interruption to existing production requirements.

Before 1994 when the program was begun, the project engineer was responsible for new program launches. Departments worked independently with little coordination between the departments and the project engineer, and there was no organization to ensure a successful launch. With limited advanced planning, the introduction of new programs suffered from lack of dedicated resources. Production workers did not see the parts until the new program reached the factory floor. Existing production took priority--not the introduction of new programs. As a

result, new program launches were unsuccessful with low yield rates, high defect rates, missed schedules, excessive costs, and interruptions in existing production.

In early 1994, Nascote dedicated resources to the new program launch effort. A Program Launch Group was established and an organized procedure put in place. The Group provided support to each department (customer) for launching new programs, provided a communications network to ensure all activities were coordinated and launch status was known. Core team members included representatives from the operations departments and the support departments. Under the Program Launch method, each department representative reviewed key processing assumptions (human resources, equipments, and facilities). Quantities and schedules were communicated to each department representative for review. Issues were identified and resolved prior to the launch.

Since the implementation of Program Launch, Nascote has launched all new programs on time and at or near their quoted prices. The transition from launch to production improved and the launch cost was reduced.

Quality Operating System

Nascote uses the Quality Operating System (QOS), a tailored metric and reporting system, throughout every department to track performance, identify problem areas, put action plans into place, set goals, and recognize achievements. Because only fragmented objectives existed prior to this system, the need for improvement was obvious. QOS highlights key measureables to ensure continuous improvement and identifies problems which may require human resource allocation for solving or reducing the problem. QOS has become a critical tool for continuous improvement at Nascote Industries.

QOS is a proven world-class business practice which helps companies determine their baselines and establish goals. It provides a standardized method for each department to establish metrics and collect performance data of programs, equipment, and processes; track the metrics data; identify problem areas; put action plans into place and develop task forces to work on them; set targets and goals; and recognize achievements.

Each department implements its own QOS, from the operations departments of injection molding, painting, and bonding, to the supporting departments of finance, purchasing, and shipping/scheduling. All department personnel can contribute to the QOS and may submit a metric to be collected and monitored. If proven to be an effective indicator of performance, it is entered into QOS. For example, the Injection Molding Department, a strong implementor of QOS, has collected data on first run yields and defects for all its products, and on key parameters for associated equipment and processes. Target lines are set and agreed upon by everyone in the department. Real-time tracking and monitoring of the collected data and its relationship with the target has become readily visible on touch screen monitors and paper reports. Concerns (problem areas) and improvements are given attention by completing a Concern Resolution Report form. This form is the action tool for addressing concerns or making improvements that lead to achieving the proposed targets. The form describes the concern or improvement, the potential root cause, prevention measures, action team leader and team members, status, and results. QOS reports are structured for monthly, weekly, and daily review. Reports are combined to provide a plant-wide summary for monthly review by upper management and staff; daily departmental summaries are reviewed by middle management and staff; and departmental summaries are prepared for daily review by supervisors, operators, engineers, and technicians. Problem areas become a focus for resolution, either through the application of additional internal attention, and/or searching externally for resolution. External consultants and expertise may also be placed on the action teams.

Effective measurements and setting goals provide the foundation of the Nascote Industries business, and QOS is a proven method for accomplishing this goal. Quality and performance of products, equipments, and processes have continuously improved to world-class levels since Nascote Industries adopted QOS as an effective way of doing business.

Vocational Instruction Practicum Program

Under the sponsorship of the state of Illinois, Nascote has engaged in a program to help high school and college teachers gain a better understanding of technology and current practices in industry. This direct participation program is the Vocational Instruction Practicum (VIP) Program.

Through the VIP Program, teachers go to Nascote for up to two weeks to receive hands-on-training to observe and apply new technology. This program enables teachers to increase their effectiveness through on-site work experiences in businesses like Nascote. The teachers are paid by grant funds from various sources. They gain essential knowledge, skills, and attitudes applicable to a variety of work activities. Teachers perform actual work on site, observe work processes and technology, and interview employers/employees about the nature of their work. The program also provides teachers with a better understanding of numerous aspects of the business while at the work site.

This VIP program provided valuable experience for teachers and had a significant impact on the quality of instruction in Illinois schools and colleges. In addition, the program has given Nascote employees the opportunity to go into the schools to share their knowledge, skills, and work experience directly with students. These efforts have helped improve the overall quality of the workforce available to Nascote and other companies in the state.

Section 3

Information

Production

Shop Floor Control System

Nascote developed an Automated Production & Process Information eXchange (NAPPIX) system to correct an ineffective shop floor data collection process. Shop floor data was previously stored on paper and filed away by department and shift. Obtaining reports using the data was extremely difficult. Schedules were distributed by hand or verbally communicated often resulting in lost, outdated, or misinterpreted schedules. Workcenters lacked feedback about performance. Information written by each shift and sent to the material control group indicated which productions were completed at each workcenter in the department.

Development of NAPPIX began in 1991 and concluded a year later. This real-time data collection and retrieval system provides inventory, process and labor information to production departments, engineering, material control, and management. Concurrently, NAPPIX provides access to process-related feedback for the machine operator and technician on the plant floor.

NAPPIX consists of over 30 industrial-strength PCS with touchscreens, Ethernet cards for network access, wedge and badge scanners 17 OHAUS scales and 22 Intermec label printers. Software consists of in-house applications (customized to each department's requirements) written in Visual Basic/Access to collect and display information to the plant floor; in-house applications written in Basic running on the factory computer (Unix based system) for faster processing; and, in-house applications written in Accessory Manager to connect to Nascote's PC-LAN and to transmit data between each touchscreen and the factory computer.

As a result of the installation of the shop floor control system, Nascote employees now have immediate access to the company Business Operating System procedures on the manufacturing floor through any factory NAPPIX workstation. This has allowed the company to progress toward a semi-paperless factory and made manufacturing information available immediately to anyone within the plant. Information on total units produced, scrapped, or reworked, is available at any PC or terminal in the plant and can be electronically transmitted to production at the end of each shift. Scheduling, labor tracking, tooling maintenance, and machine monitoring information is also available anywhere within the plant. SPC data, collected on the shop floor, is also accessible to the entire plant as needed.

Zontec SPC

Nascote Industries has applied SPC at its Nashville, Illinois plant since the late 1980s to monitor, control, evaluate, and analyze many of the manufacturing processes. As new SPC packages have been developed, Nascote implemented several as the use of SPC increased throughout the plant. However, these different SPC packages created islands of information and caused confusion among users when trying to locate specific data. Nascote determined that with a centralized database, a user-friendly Windows interface, and the ability to import data from other applications, consolidation of all of these islands of information would be possible. Consolidation would be cost effective since Nascote already had over 95% of the plant's PCS and touchscreens connected to the plant's PC-LAN. To accomplish this task, Nascote purchased an SPC software package, Zontec-SPC, in mid-1995 to help Nascote standardize most of the SPC charts and data.

Using the Zontec software, the data on Nascote's production process became easily obtainable throughout the plant. Data being tracked with the Zontec SPC software included molding gage data, bonding gage data, reactive induction molding data, quality data, and paint data (including paint temperatures, paint viscosities, yields and contamination data). Future plans called for expanding Zontec SPC to all other areas in the plant which have a need for SPC.

Management

Business Operating System

The Business Operating System (BOS) at Nascote, developed in 1992, is a formal method to identify all business systems necessary for QS-9000 and to

standardize procedures for documenting core processes. Nascote had no formal methods in place for development and control of documents such as instructions, policies, procedures, and forms. Documents and forms, developed at Nascote individually and without standardized formats, often resulted in duplicated efforts. In addition, only hard copies of documents were available. BOS was developed to eliminate repeated efforts, eliminate key tasks being missed, provide a clear definition of responsibilities and accountability, provide better document control, and improve business processes overall.

Nascote assembled a list of required documents for its core business processes as the initial step in the BOS implementation. Cross-functional teams were formed for each process to review the existing process and recommend the best process for Nascote. The processes, procedures, and policies were documented in a standardized format and entered into an automated system. The system, run on the company's PC-based LAN, used a standard Windows-based word processor and database system.

BOS ensures that controlled documents are updated and distributed in a timely manner, with only the most current documents and forms issued at the workplace. Obsolete material is removed and archived, and company documents are standardized in numbering, content, terminology, symbolism, and format. BOS has consequently helped Nascote address all QS-9000 elements adequately. All employees have access to the documents in the system from computer terminals located throughout the plant. The system has reduced the need for some paper versions of documents and forms.

Career Development Program

The Career Development Program is being developed by Nascote as a management tool to guide and support individualized training plans based on career goals and the current educational needs of individuals and organizations.

Training and education of the Nascote workforce provides the foundation for competing in the global market, continuous improvement, and promotions within the company. Nascote supports employee development by encouraging its workforce to achieve specific business objectives and personal growth.

The Career Development program will be available to all Nascote employees. This program has begun to assess the employees' basic skills and has initiated college placement testing. All tests were given in a supportive manner and held confidential. Education and training requirements in a specific field have been identified.

In interviews employees will determine their long range goals -- or where they want to be in five years. Pre-testing assessment will rank skill levels compared to other employees. Career planning will be performed through employee and management counseling, and individual career paths will be developed with specific training and education identified, and will be submitted to management for approval with a schedule established for completion.

The Career Development program is being designed to benefit both the business objectives of Nascote and the personal growth of the individual employee.

Community/Nascote Partnership

Nascote Industries has played a vital role in developing the current and future business leaders in the community through partnership development with area academia, businesses, organizations, and government. Nascote, one of the largest industries in the community, has drawn on the resource base to meet its employment and business needs. An educated resource base remains critical to the company's current and future growth.

The resource base Nascote has drawn upon was unprepared and required additional training and education when filling the company's employment requirements. Other industries in the area also counted on this base to fulfill their hiring needs. They found turmoil existed between the educators and the workforce in communicating and agreeing on what educational needs the industrial market required as part of its resource base. To bridge the gap, Nascote brought groups together by developing an Education-to-Careers Partnership in April 1996. The partnership included area colleges, community colleges, technical preparatory schools, high schools, middle schools, vocational educational institutions, and 50 area industries. The partnership focused on

- working toward high expectations of all students,
- developing more motivated students,
- providing more employer support for education,
- better preparing workers and citizens, and
- creating an educated, competent, and multi-generational region.

An Executive Committee oversaw the activities, programs, and progress of the partnership. Ad Hoc Committees were established as needed to address such issues as communications, school-based learning, work-based learning, and skills standards. Membership included business, industry, community organizations, teachers and administrators from elementary, secondary, and high school education, college, public agencies, students, parents, and organized labor.

Nascote Industries participated in forming the partnership and setting up the organizational structure of the Executive Committee. It also assisted in reviewing academic curriculum, providing advice on workforce needs, hosting facility tours, and participating in career fairs.

Through its participation in the partnership, Nascote showed it not only promoted the products it produced on the factory floor, but also supported the people in the surrounding community.

Teaming and Employee Involvement

Nascote looked at employee involvement in 1990 and established several initiatives to introduce teaming and further employee buy-in. There had been little or no employee involvement in company operations other than their performance of assigned duties. A management steering committee and multiple tasks forces ran the Total Quality program with little input or representation from the hourly employees.

Training introduced new team concepts to managers first and then to the remaining employee population. Each employee received several weeks of training in team building and problem solving skills. Leadership training was similarly provided first to managers and then extended to all hourly personnel. Specific empowerment training focusing on communications, conflict resolution, and values was provided to all employees. Upon completion of training, employees were encouraged to pick a problem, form a team, and work through the problem to a solution. Initially there was very high resistance to teams from both employees and management but this was overcome as the team approach was better understood. Gradually, more teams were developed to solve problems and make improvements.

There are 242 active teams at Nascote involving nearly 96% of the workforce. Increasingly, these empowered teams are evolving into self-directed teams; about one-fifth of the employees are now members of self-directed teams. The company encouraged this evolution by providing additional training to employees to facilitate the transition from empowered teams to self-directed teams. The company also provided a number of ways to recognize and reward team achievements such as banquets, team celebrations, thank you cards, gift certificates, trips, family dinners, and company jackets. Nascote teams have also been recognized for their achievements at the state and national levels. They received the Illinois Manufacturing Association Team Excellence Award, the Association for Quality and Participation National Team Excellence Award, and were an Association for Quality and Participation Regional Winner.

Nascote is committed to its teaming concept to build the future of the company. Through employee involvement and team efforts, Nascote secured contracts that guarantee the existence of the company and employment for its workers through the year 2003. Employee involvement is becoming a way of life at Nascote as its teams continue to get involved in business development, planning, and plant-wide operations.

Appendix A
Table of Acronyms

Acronym	**Definition**
8-D	8 Discipline
BOS	Business Operating System
DOE	Design of Experiments
EPI	Environmental Purification Industries
IEPA	Illinois Environmental Protection Agency
NAPPIX	Nascote Automated Production and Process Information eXchange
QOS	Quality Operating System
RIM	Reaction Injection Molded
VIP	Vocational Instruction Practicum
VOC	Volatile Organic Compound
WVP	Wireless Voice Platform

Appendix B

BMP Survey Team

Team Member	Activity	Function
Larry Robertson (812) 854-5336	**Crane Division** **Naval Surface Warfare Center** Crane, IN	**Team Chairman**
Amy Scanlan (301) 403-8100	**BMP Center of Excellence** College Park, MD	**Technical Writer**
Stacey M. Jones (301) 403-8100	**BMP Center of Excellence** College Park, MD	**Technical Administrative Assistant**

Production Team

Team Member	Activity	Function
Don Hill (317) 306-3781	**Naval Air Warfare Center** **Aircraft Division** Indianapolis, IN	**Team Leader**
Clint McCormick (317) 306-3361	**Naval Air Warfare Center** **Aircraft Division** Indianapolis, IN	

Management Team

Team Member	Activity	Function
Rick Purcell (301) 403-8100	**BMP Center of Excellence** College Park, MD	**Team Leader**
Larry Halbig (317) 306-3838	**Naval Air Warfare Center** **Aircraft Division** Indianapolis, IN	

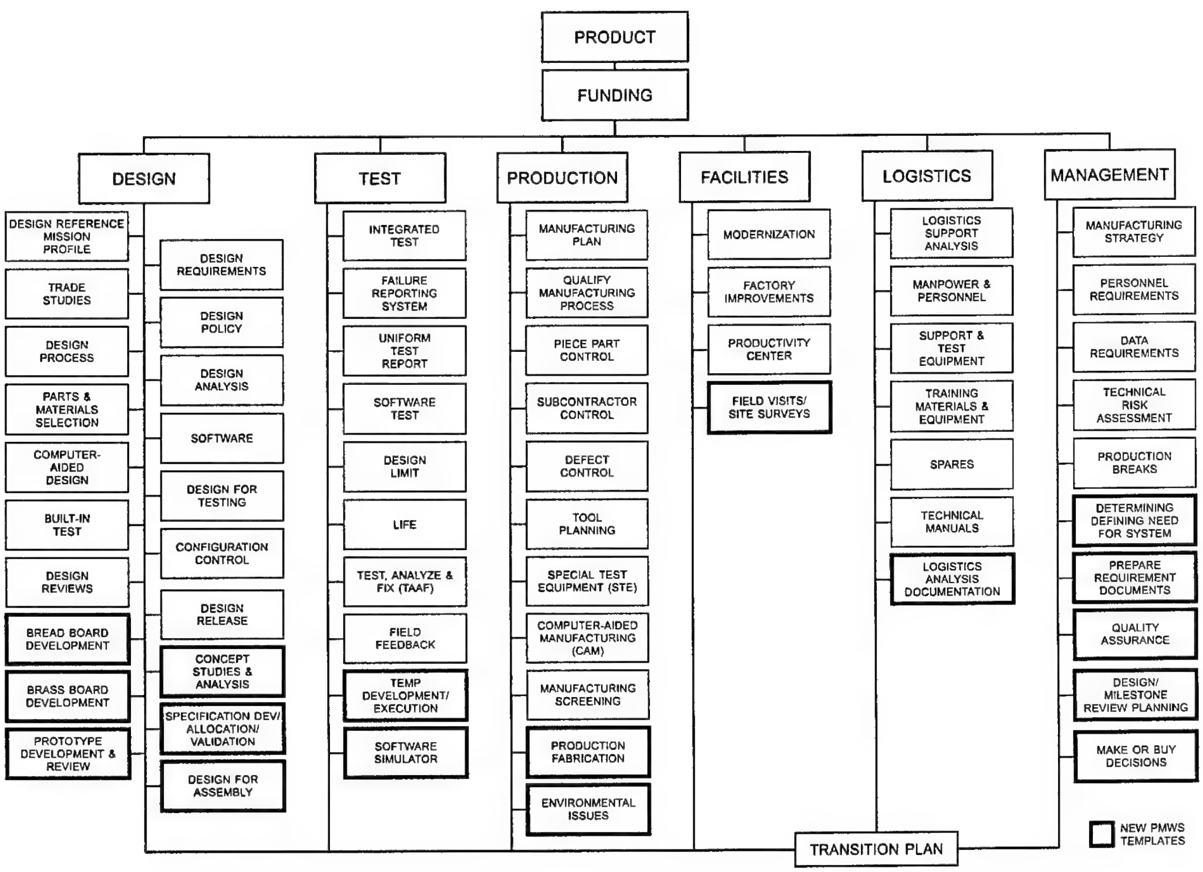
Appendix C

Critical Path Templates and BMP Templates

This survey was structured around and concentrated on the functional areas of design, test, production, facilities, logistics, and management as presented in the Department of Defense 4245.7-M, *Transition from Development to Production* document. This publication defines the proper tools—or templates—that constitute the critical path for a successful material acquisition program. It describes techniques for improving the acquisition process by addressing it as an *industrial* process that focuses on the product's design, test, and production phases which are interrelated and interdependent disciplines.

The BMP program has continued to build on this knowledge base by developing 17 new templates that complement the existing DOD 4245.7-M templates. These BMP templates address new or emerging technologies and processes.

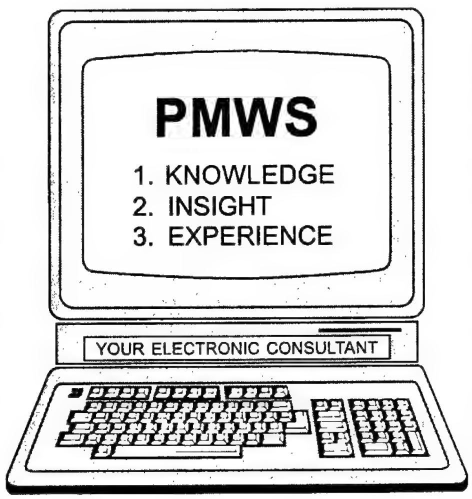
"CRITICAL PATH TEMPLATES FOR TRANSITION FROM DEVELOPMENT TO PRODUCTION"



Appendix D

BMPnet and the Program Manager's WorkStation

The BMPnet, located at the Best Manufacturing Practices Center of Excellence (BMPCOE) in College Park, Maryland, supports several communication features. These features include the Program Manager's WorkStation (**PMWS**), electronic mail and file transfer capabilities, as well as access to Special Interest Groups (SIGs) for specific topic information and communication. The BMPnet can be accessed through the World Wide Web (at http://www.bmpcoe.org), through free software that connects directly over the Internet or through a modem. The PMWS software is also available on CD-ROM.



PMWS provides users with timely acquisition and engineering information through a series of interrelated software environments and knowledge-based packages. The main components of PMWS are KnowHow, SpecRite, the Technical Risk Identification and Mitigation System (TRIMS), and the BMP Database.

KnowHow is an intelligent, automated program that provides rapid access to information through an intelligent search capability. Information currently available in KnowHow handbooks includes Acquisition Streamlining, Non-Development Items, Value Engineering, NAVSO P-6071 (Best Practices Manual), MIL-STD-2167/2168 and the DoD 5000 series documents. KnowHow cuts document search time by 95%, providing critical, user-specific information in under three minutes.

SpecRite is a performance specification generator based on expert knowledge from all uniformed services. This program guides acquisition personnel in creating specifications for their requirements, and is structured for the build/approval process. SpecRite's knowledge-based guidance and assistance structure is modular, flexible, and provides output in MIL-STD 961D format in the form of editable WordPerfect® files.

TRIMS, based on DoD 4245.7-M (the transition templates), NAVSO P-6071, and DoD 5000 event-oriented acquisition, helps the user identify and rank a program's high-risk areas. By helping the user conduct a full range of risk assessments throughout the acquisition process, TRIMS highlights areas where corrective action can be initiated before risks develop into problems. It also helps users track key project documentation from concept through production including goals, responsible personnel, and next action dates for future activities.

The **BMP Database** contains proven best practices from industry, government, and the academic communities. These best practices are in the areas of design, test, production, facilities, management, and logistics. Each practice has been observed, verified, and documented by a team of government experts during BMP surveys.

Access to the BMPnet through dial-in or on Internet requires a special modem program. This program can be obtained by calling the BMPnet Help Desk at (301) 403-8179 or it can be downloaded from the World Wide Web at http://www.bmpcoe.org. To receive a user/e-mail account on the BMPnet, send a request to helpdesk@bmpcoe.org.

Appendix E

Best Manufacturing Practices Satellite Centers

There are currently six Best Manufacturing Practices (BMP) satellite centers that provide representation for and awareness of the BMP program to regional industry, government and academic institutions. The centers also promote the use of BMP with regional Manufacturing Technology Centers. Regional manufacturers can take advantage of the BMP satellite centers to help resolve problems, as the centers host informative, one-day regional workshops that focus on specific technical issues.

Center representatives also conduct BMP lectures at regional colleges and universities; maintain lists of experts who are potential survey team members; provide team member training; identify regional experts for inclusion in the BMPnet SIG e-mail; and train regional personnel in the use of BMP resources such as the BMPnet.

The six BMP satellite centers include:

California

Chris Matzke
BMP Satellite Center Manager
Naval Warfare Assessment Division
Code QA-21, P. O. Box 5000
1456 Mariposa Drive
Corona, CA 91718
(909) 273-4992
FAX: (909) 273-5315
cmatzke@bmpcoe.org

Jack Tamargo
BMP Satellite Center Manager
257 Cottonwood Drive
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tgraham@bmpcoe.org

Appendix F

Navy Manufacturing Technology Centers of Excellence

The Navy Manufacturing Sciences and Technology Program established the following Centers of Excellence (COEs) to provide focal points for the development and technology transfer of new manufacturing processes and equipment in a cooperative environment with industry, academia, and Navy centers and laboratories. These COEs are consortium-structured for industry, academia, and government involvement in developing and implementing technologies. Each COE has a designated point of contact listed below with the individual COE information.

Best Manufacturing Practices Center of Excellence

The Best Manufacturing Practices Center of Excellence (BMPCOE) provides a national resource to identify and promote exemplary manufacturing and business practices and to disseminate this information to the U.S. Industrial Base. The BMPCOE was established by the Navy's BMP program, Department of Commerce's National Institute of Standards and Technology, and the University of Maryland at College Park, Maryland. The BMPCOE improves the use of existing technology, promotes the introduction of improved technologies, and provides non-competitive means to address common problems, and has become a significant factor in countering foreign competition.

Point of Contact:
Mr. Ernie Renner
Best Manufacturing Practices Center of Excellence
4321 Hartwick Road
Suite 400
College Park, MD 20740
(301) 403-8100
FAX: (301) 403-8180
ernie@bmpcoe.org

Center of Excellence for Composites Manufacturing Technology

The Center of Excellence for Composites Manufacturing Technology (CECMT) provides a national resource for the development and dissemination of composites manufacturing technology to defense contractors and subcontractors. The CECMT is managed by the GreatLakes Composites Consortium and represents a collaborative effort among industry, academia, and government to develop, evaluate, demonstrate, and test composites manufacturing technologies. The technical work is problem-driven to reflect current and future Navy needs in the composites industrial community.

Point of Contact:
Dr. Roger Fountain
Center of Excellence for Composites Manufacturing Technology
103 Trade Zone Drive
Suite 26C
West Columbia, SC 29170
(803) 822-3705
FAX: (803) 822-3730
frglcc@aol.com

Electronics Manufacturing Productivity Facility

The Electronics Manufacturing Productivity Facility (EMPF) identifies, develops, and transfers innovative electronics manufacturing processes to domestic firms in support of the manufacture of affordable military systems. The EMPF operates as a consortium comprised of industry, university, and government participants, led by the American Competitiveness Institute under a CRADA with the Navy.

Point of Contact:
Mr. Alan Criswell
Electronics Manufacturing Productivity Facility
Plymouth Executive Campus
Bldg 630, Suite 100
630 West Germantown Pike
Plymouth Meeting, PA 19462
(610) 832-8800
FAX: (610) 832-8810
http://www.engriupui.edu/empf/

National Center for Excellence in Metalworking Technology

The National Center for Excellence in Metalworking Technology (NCEMT) provides a national center for the development, dissemination, and implementation of advanced technologies for metalworking products and processes. The NCEMT, operated by Concurrent Technologies Corporation, helps the Navy and defense contractors improve

manufacturing productivity and part reliability through development, deployment, training, and education for advanced metalworking technologies.

Point of Contact:
Mr. Richard Henry
National Center for Excellence in Metalworking Technology
1450 Scalp Avenue
Johnstown, PA 15904-3374
(814) 269-2532
FAX: (814) 269-2799
henry@ctc.com

Navy Joining Center

The Navy Joining Center (NJC) is operated by the Edison Welding Institute and provides a national resource for the development of materials joining expertise and the deployment of emerging manufacturing technologies to Navy contractors, subcontractors, and other activities. The NJC works with the Navy to determine and evaluate joining technology requirements and conduct technology development and deployment projects to address these issues.

Point of Contact:
Mr. David P. Edmonds
Navy Joining Center
1100 Kinnear Road
Columbus, OH 43212-1161
(614) 487-5825
FAX: (614) 486-9528
dave_edmonds@ewi.org

Energetics Manufacturing Technology Center

The Energetics Manufacturing Technology Center (EMTC) addresses unique manufacturing processes and problems of the energetics industrial base to ensure the availability of affordable, quality energetics. The focus of the EMTC is on process technology with a goal of reducing manufacturing costs while improving product quality and reliability. The COE also maintains a goal of development and implementation of environmentally benign energetics manufacturing processes.

Point of Contact:
Mr. John Brough
Energetics Manufacturing Technology Center
Indian Head Division
Naval Surface Warfare Center
Indian Head, MD 20640-5035
(301) 743-4417
DSN: 354-4417
FAX: (301) 743-4187
mt@command.nosih.sea06.navy.mil

Manufacturing Science and Advanced Materials Processing Institute

The Manufacturing Science and Advanced Materials Processing Institute (MS&MPI) is comprised of three centers including the National Center for Advanced Drivetrain Technologies (NCADT), The Surface Engineering Manufacturing Technology Center (SEMTC), and the Laser Applications Research Center (LaserARC). These centers are located at The Pennsylvania State University's Applied Research Laboratory. Each center is highlighted below.

Point of Contact for MS&MPI:
Mr. Dennis Herbert
Manufacturing Science and Advanced Materials Processing Institute
ARL Penn State
P.O. Box 30
State College, PA 11804-0030
(814) 865-8205
FAX: (814) 863-0673
dbh5@psu.edu

- **National Center for Advanced Drivetrain Technologies**
  The NCADT supports DoD by strengthening, revitalizing, and enhancing the technological capabilities of the U.S. gear and transmission industry. It provides a site for neutral testing to verify accuracy and performance of gear and transmission components.

  Point of Contact for NCADT:
  Dr. Suren Rao
  National Center for Advanced Drivetrain Technologies
  ARL Penn State
  P.O. Box 30
  State College, PA 16804-0030
  (814) 865-3537
  FAX: (814) 863-1183
  http://www.arl.psu.edu/drivetrain_center.html/

- **Surface Engineering Manufacturing Technology Center**

  The SEMTC enables technology development in surface engineering—the systematic and rational modification of material surfaces to provide desirable material characteristics and performance. This can be implemented for complex optical, electrical, chemical, and mechanical functions or products that affect the cost, operation, maintainability, and reliability of weapon systems.

  Point of Contact for SEMTC:
  Surface Engineering Manufacturing Technology Center
  Dr. Maurice F. Amateau
  SEMTC/Surface Engineering Center
  P.O. Box 30
  State College, PA 16804-0030
  (814) 863-4214
  FAX: (814) 863-0006
  http://www/arl.psu.edu/divisions/arl_org.html

- **Laser Applications Research Center**

  The LaserARC is established to expand the technical capabilities of DOD by providing access to high-power industrial lasers for advanced material processing applications. LaserARC offers basic and applied research in laser-material interaction, process development, sensor technologies, and corresponding demonstrations of developed applications.

  Point of Contact for LaserARC:
  Mr. Paul Denney
  Laser Center
  ARL Penn State
  P.O. Box 30
  State College, PA 16804-0030
  (814) 865-2934
  FAX: (814) 863-1183
  http://www/arl.psu.edu/divisions/arl_org.html

Gulf Coast Region Maritime Technology Center

The Gulf Coast Region Maritime Technology Center (GCRMTC) is located at the University of New Orleans and will focus primarily on product developments in support of the U.S. shipbuilding industry. A sister site at Lamar University in Orange, Texas will focus on process improvements.

Point of Contact:
Dr. John Crisp
Gulf Coast Region Maritime Technology Center
University of New Orleans
Room N-212
New Orleans, LA 70148
(504) 286-3871
FAX: (504) 286-3898

Appendix G

Completed Surveys

As of this publication, 85 surveys have been conducted by BMP at the companies listed below. Copies of older survey reports may be obtained through DTIC or by accessing the BMPnet. Requests for copies of recent survey reports or inquiries regarding the BMPNET may be directed to:

Best Manufacturing Practices Program
4321 Hartwick Rd., Suite 400
College Park, MD 20740
Attn: Mr. Ernie Renner, Director
Telephone: 1-800-789-4267
FAX: (301) 403-8180
ernie@bmpcoe.org

1985	Litton Guidance & Control Systems Division - Woodland Hills, CA
1986	Honeywell, Incorporated Undersea Systems Division - Hopkins, MN (Alliant TechSystems, Inc.) Texas Instruments Defense Systems & Electronics Group - Lewisville, TX General Dynamics Pomona Division - Pomona, CA Harris Corporation Government Support Systems Division - Syosset, NY IBM Corporation Federal Systems Division - Owego, NY Control Data Corporation Government Systems Division - Minneapolis, MN
1987	Hughes Aircraft Company Radar Systems Group - Los Angeles, CA ITT Avionics Division - Clifton, NJ Rockwell International Corporation Collins Defense Communications - Cedar Rapids, IA UNISYS Computer Systems Division - St. Paul, MN (Paramax)
1988	Motorola Government Electronics Group - Scottsdale, AZ General Dynamics Fort Worth Division - Fort Worth, TX Texas Instruments Defense Systems & Electronics Group - Dallas, TX Hughes Aircraft Company Missile Systems Group - Tucson, AZ Bell Helicopter Textron, Inc. - Fort Worth, TX Litton Data Systems Division - Van Nuys, CA GTE C^3 Systems Sector - Needham Heights, MA
1989	McDonnell-Douglas Corporation McDonnell Aircraft Company - St. Louis, MO Northrop Corporation Aircraft Division - Hawthorne, CA Litton Applied Technology Division - San Jose, CA Litton Amecom Division - College Park, MD Standard Industries - LaMirada, CA Engineered Circuit Research, Incorporated - Milpitas, CA Teledyne Industries Incorporated Electronics Division - Newbury Park, CA Lockheed Aeronautical Systems Company - Marietta, GA Lockheed Corporation Missile Systems Division - Sunnyvale, CA Westinghouse Electronic Systems Group - Baltimore, MD General Electric Naval & Drive Turbine Systems - Fitchburg, MA Rockwell International Corporation Autonetics Electronics Systems - Anaheim, CA TRICOR Systems, Incorporated - Elgin, IL
1990	Hughes Aircraft Company Ground Systems Group - Fullerton, CA TRW Military Electronics and Avionics Division - San Diego, CA MechTronics of Arizona, Inc. - Phoenix, AZ Boeing Aerospace & Electronics - Corinth, TX

1990 (Continued)	Technology Matrix Consortium - Traverse City, MI Textron Lycoming - Stratford, CT
1991	*Resurvey of Litton Guidance & Control Systems Division* - Woodland Hills, CA Norden Systems, Inc. - Norwalk, CT Naval Avionics Center - Indianapolis, IN United Electric Controls - Watertown, MA Kurt Manufacturing Co. - Minneapolis, MN MagneTek Defense Systems - Anaheim, CA Raytheon Missile Systems Division - Andover, MA AT&T Federal Systems Advanced Technologies and AT&T Bell Laboratories - Greensboro, NC and Whippany, NJ *Resurvey of Texas Instruments Defense Systems & Electronics Group* - Lewisville, TX
1992	Tandem Computers - Cupertino, CA Charleston Naval Shipyard - Charleston, SC Conax Florida Corporation - St. Petersburg, FL Texas Instruments Semiconductor Group Military Products - Midland, TX Hewlett-Packard Palo Alto Fabrication Center - Palo Alto, CA Watervliet U.S. Army Arsenal - Watervliet, NY Digital Equipment Company Enclosures Business - Westfield, MA and Maynard, MA Computing Devices International - Minneapolis, MN *(Resurvey of Control Data Corporation Government Systems Division)* Naval Aviation Depot Naval Air Station - Pensacola, FL
1993	NASA Marshall Space Flight Center - Huntsville, AL Naval Aviation Depot Naval Air Station - Jacksonville, FL Department of Energy Oak Ridge Facilities (Operated by Martin Marietta Energy Systems, Inc.) - Oak Ridge, TN McDonnell Douglas Aerospace - Huntington Beach, CA Crane Division Naval Surface Warfare Center - Crane, IN and Louisville, KY Philadelphia Naval Shipyard - Philadelphia, PA R. J. Reynolds Tobacco Company - Winston-Salem, NC Crystal Gateway Marriott Hotel - Arlington, VA Hamilton Standard Electronic Manufacturing Facility - Farmington, CT Alpha Industries, Inc. - Methuen, MA
1994	Harris Semiconductor - Melbourne, FL United Defense, L.P. Ground Systems Division - San Jose, CA Naval Undersea Warfare Center Division Keyport - Keyport, WA Mason & Hanger - Silas Mason Co., Inc. - Middletown, IA Kaiser Electronics - San Jose, CA U.S. Army Combat Systems Test Activity - Aberdeen, MD Stafford County Public Schools - Stafford County, VA
1995	Sandia National Laboratories - Albuquerque, NM Rockwell Defense Electronics Collins Avionics & Communications Division - Cedar Rapids, IA *(Resurvey of Rockwell International Corporation Collins Defense Communications)* Lockheed Martin Electronics & Missiles - Orlando, FL McDonnell Douglas Aerospace (St. Louis) - St. Louis, MO *(Resurvey of McDonnell-Douglas Corporation McDonnell Aircraft Company)* Dayton Parts, Inc. - Harrisburg, PA Wainwright Industries - St. Peters, MO Lockheed Martin Tactical Aircraft Systems - Fort Worth, TX *(Resurvey of General Dynamics Fort Worth Division)* Lockheed Martin Government Electronic Systems - Moorestown, NJ Sacramento Manufacturing and Services Division - Sacramento, CA JLG Laboratories, Inc. - McConnellsburg, PA
1996	City of Chattanooga - Chattanooga, TN Mason & Hanger Corporation - Pantex Plant - Amarillo, TX Nascote Industries, Inc. - Nashville, IL